

NVIS/NVG COCKPIT COMPATIBILITY CHECKLIST: GROUND, NIGHT

NVIS Compatibility - Ground Evaluation Setup

a. Required Items:

(1) A facility that can be sealed from all light sources. The facility must have a minimum of 25 feet of space in front and 20 feet to either side of the aircraft to accommodate test equipment setup.

Note: If the Tri-bar chart is visible with unaided vision, the facility is not dark enough.

(2) Visual Acuity Chart (a USAF 1951 Resolution Resolving Power Target Medium Contrast (Tri-Bar) Chart and USAF 1951 Resolution Resolving Power Target High Contrast (Tri-Bar) Chart, copies at end of check list)

(3) Visual acuity chart illuminator capable of illuminating acuity charts at levels found in Table 1 – Lux. (See attachment 3 for suggestions on how to build an illuminator)

(4) Light meter capable of measuring in hundredths of LUX at levels found in Table 1 – Lux.

(5) At least two NVG helmets with mounts for front seat evaluators. NVG hand held mounts with power supply can be used for other observers if desired.

	Manufacturer	Model	Serial Number
Pilot			
Copilot			
Obs 1			
Obs 2			

(6) A minimum of one set of NVG for each front seat evaluator that meets TSO-C164 or RTCA/DO-275 specifications.

- Use the same type/model of NVG that operator will use in flight if possible.

(7) Familiarize evaluator crew with A/C switch locations/positions so they can activate correct switches in a dark environment (BAT, NAV, COMM, Lights, operation equipment, etc.)

b. Setup

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(1) Position the aircraft in a facility that can be sealed from all light sources. The facility must have a minimum of 25 feet of space in front and 20 feet to either side of the aircraft to accommodate test equipment setup.

(2) Check and clean if necessary the windscreen/windows to remove any smudges and bugs. Ensure the windscreen is not excessively scratched.

(3) Provide at least two each NVG helmets with mounts for front seat evaluators. NVG hand held mounts with power supply if desired for other observers.

(4) Provide at least two each Night Vision Goggles with the same model used by the applicant for operations. Record the NVG information below.

	Manufacturer	Model	Serial Number
Pilot			
Copilot			

(5) Connect appropriate ground power unit to facility power and to the aircraft GPU connector. Do not turn ground power on until instructed.

(6) Evaluator must be familiar with A/C switch positions and be able to activate correct switches during a darkened condition (BAT, NAV, COMM, Lights, operating equipment, etc.).

(7) Position on a stand a USAF 1951 Resolution Resolving Power Target Medium Contrast (Tri-Bar) Chart (Air Methods Part Number 738-1999-001) and USAF 1951 Resolution Resolving Power Target High Contrast (Tri-Bar) Chart 20 feet in front of and level with the pilot's eye position (see Figure 1).

(8) A Visual Acuity Chart Illuminator will be used to illuminate the resolution chart. Place the illuminator at the distance discussed in the chart from Table 1. Assess whether or not the light source illuminates or casts shadows into the cockpit. If it does, move it to eliminate any cockpit illumination or shadows.

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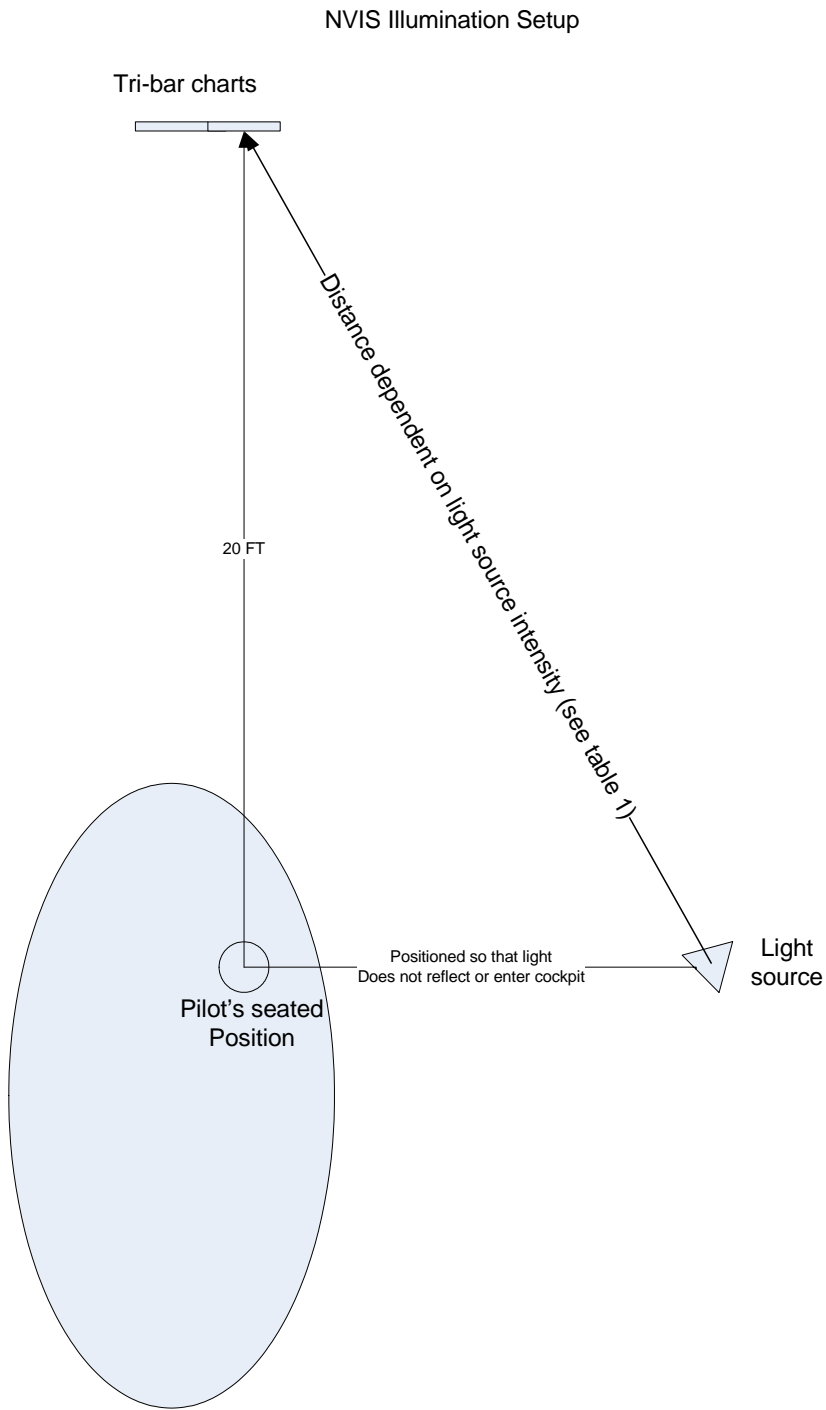


Figure 1 – Target and Illuminator Setup

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(9) Connect the illuminator to 115 VAC 60 Hz power supplied from the testing facility.

(10) Position light meter sensor 12.0 inches from the front of the light source baffle.

Note: Distance is critical, be as accurate as possible.

(11) Set the light meter switch to measure in LUX.

(12) Turn on the Illuminator and turn off all hangar lights.

(13) Record the reading for the light meter.

Light meter Lux Reading: _____

(14) Locate the Lux value in the first column of the Table 1 below and record value.

	Distance		
Lux @ 12 inches	Decimal (ft)	Feet	Inches
.08	14.48	14	5 $\frac{3}{4}$
.09	15.35	15	4 $\frac{1}{4}$
.10	16.18	16	2 $\frac{1}{4}$
.11	16.97	16	11 $\frac{3}{4}$
.12	17.73	17	8 $\frac{3}{4}$
.13	18.45	18	5 $\frac{1}{2}$
.14	19.15	19	1 $\frac{3}{4}$
.15	19.82	19	9 $\frac{3}{4}$
.16	20.47	20	5 $\frac{3}{4}$
.17	21.10	21	1 $\frac{1}{4}$
.18	21.71	21	8 $\frac{1}{2}$
.19	22.31	22	3 $\frac{3}{4}$
.20	22.89	22	10 $\frac{3}{4}$
.21	23.45	23	5 $\frac{1}{2}$
.22	24.01	24	0
.23	24.55	24	6 $\frac{1}{2}$
.24	25.07	25	$\frac{3}{4}$
.25	25.59	25	7
.26	26.10	26	1 $\frac{1}{4}$

Table 1 – Lux

Lux Distance Value: _____

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(15) Set the distance from the Illuminator to the Target by moving the Illuminator to the distance recorded in Step 14 (See Figure 1).

(16) Ensure the target is centered in the illuminated area and that the light does not enter the cockpit or reflect into the cockpit onto the instrument panel. This may be accomplished by observing the cockpit and instrument panel using NVGs.

(17) Allow at least 10 minutes to let eyes adjust to darkness.

(18) Focus NVG goggles per manufacturer's instruction. This is best accomplished using a slightly higher light condition than provided by the illuminator.

(19) Verify NVGs are functioning properly and have no defects that would affect test results.

(20) Stand outside aircraft, abeam pilot position (20 feet from illuminated chart) and focus NVG to obtain maximum resolution on chart (smallest set of horizontal and vertical bars). Record the chart line resolution below:

Original Chart line resolution: _____

(21) Note: All chart readings will use the original resolution as the baseline comparison. The object is to determine visual degradation as a result of light/object/reflection interference.

(22) Turn off Illuminator.

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NVIS Lighting System Evaluation: Unaided Night Readability

Setup:

- a. Aircraft in blacked out hangar or blacked out windows (If evaluation is accomplished in same session as NVG compatibility evaluation, use a blacked out hangar that is sealed from external light leaks.)
- b. Use pilots 5' 2" to 6'0" in height to assess both visibility and ability to reach controls.
- c. Determine ability to turn off CAWS panel (CB, fuse, etc.). Otherwise, be able to block the CAWS panel from view with cardboard, etc.

Objective: Evaluate unaided visual performance of the lighting system to assess compliance with 14 CFR Part 27 or 29 requirements.

#	Item/Test	Comment/Remark
1	Alternate lighting controls are easily identified, reached, and safely manipulated with one hand by pilot flying.	
2	If the NVIS lighting is on a separate switch from the primary lighting system, the switch is easily distinguished from the primary lighting switch.	
3	Alternate lighting design and controls allow for balanced illumination of each portion of the instrument panel.	
4	Alternate lighting design does not induce inadvertent action of controls.	
5	If overlays are used, the overlay does not obscure instrument or gauge numbers, markings, or symbols.	
6	Instruments/gauges with post lights are sufficiently illuminated so that the entire display is readable from both front seat positions and other positions in accordance with 14 CFR § 27/29.1321.	
7	Alternate lighting on posts do not cause glare or distracting reflections off of gauges/instruments	
8	The alternate lighting system (including floodlights) does not cause more glare/reflections off the windscreen/windows than the primary system. (Outside visibility is not decreased when using the alternate lighting system when compared to the original or primary lighting system).	

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9	MAP/Emergency/Flood lights do not cast shadows that obscure instrument markings, switches, or labels nor do they shine into the pilots' eyes or cause reflections off instruments that shine into the pilots' eyes.	
10	Alternate lighting power source is separate from primary power source (unless applicant makes the "alternate" system the "primary" system). If "primary" system, then power requirements must meet 14 CFR 27 or 29 requirements.	
11	MASTER WARNING & WARNING LIGHTS a. Filtered Master Warning, CAWS panel warning lights that use NVIS Red are distinguishable as "red" compared to other lights on the instrument panel (there are no other red lights on the instrument panel that are true red that could lead to confusion.) b. Bright and distinguishable enough to capture pilot's attention. c. The color used for Red is uniform throughout the cockpit to avoid possible confusion (NVIS Red looks "orange" compared to true red. The concern is confusion of NVIS red for amber.)	
12	MASTER CAUTION & CAUTION LIGHTS a. Filtered Master Caution, CAWS panel caution lights that use NVIS Yellow are distinguishable as amber/yellow compared to NVIS Red lamps. (Do not look green, white, orange) b. Bright and distinguishable enough to capture pilot's attention. c. The color used for yellow/amber is uniform throughout the cockpit to avoid possible confusion (NVIS Yellow has slight green tinge compared to true yellow. Additionally, Amber may be confused with NVIS Red.)	

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NVIS lighting installation – NVG compatibility testing:

- a. Test steps in accordance with RTCA 275
- b. All tests conducted with NVG ON and in viewing position
- c. Determine ability to turn off CAWS panel (CB, fuse, etc). Otherwise, be able to block the CAWS panel from view with cardboard, etc.
- d. Tests conducted sitting in left/right/crew (if crewmember required to use NVG's) seats
- e. NOTE: During ground tests, the applicant should ensure that the appropriate voltage is provided to represent flight conditions.

Objective: Ensure the installed lighting and filtered instruments do not interfere with NVG performance.

#	Item	Comment/Remark
1.	All cockpit lights - OFF, View target through aircraft windscreen from each crew position. Record chart line visibility Acceptable degradation = 12% (one resolution element larger from <u>original</u> resolution)	Chart Line:_____

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#	Item	Comment/Remark
2.	<p>NVIS Instrument lights – OFF (including filtered instruments)</p> <p>NVIS MAP/Emergency/flood lights – ON</p> <p>NVIS Filtered Equipment (i.e., radio stacks, GPS, clocks, etc.) – OFF</p> <p>Illumination level – SET TO NVG OPERATIONAL LEVEL</p> <p>a. View target through aircraft windscreen.</p> <p>Record chart line visibility</p> <p>Acceptable degradation = 12% (one resolution element from <u>original</u> resolution)</p> <p>b. Record and assess any reflections/glare created by the MAP/Emergency/Flood lights.</p> <p>c. Scan the instrument panel and consoles and record any light leaks, “hot spots”, or glare in NVG and its effect on NVG performance.</p> <p>d. Record position, type, and effect of any instrument light reflections in windscreen/windows seen through the NVG and effect on NVG performance/outside visibility.</p>	<p>Chart Line:_____</p>

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#	Item	Comment/Remark
3.	<p>NVIS Instrument lights – ON (including filtered instruments)</p> <p>NVIS flood lights – OFF</p> <p>NVIS Filtered equipment (e.g., radio stacks, GPS, clock, etc) - OFF</p> <p>Illumination level – SET TO NVG OPERATIONAL LEVEL</p> <p>a. View target through aircraft windscreen. Record chart line visibility</p> <p>Acceptable degradation = 12% (one resolution element larger from <u>original</u> resolution)</p> <p>b. Scan the instrument panel and consoles and record any light leaks, “hot spots”, or glare in NVG and its effect on NVG performance.</p> <p>c. Record position, type, and effect of any instrument light reflections in windscreen/windows seen through the NVG and effect on NVG performance/outside visibility.</p> <p>NOTE: Pay attention to warning/failed flags, off flags, marker lights, other lights accompanying instrument lights that might illuminate and could cause degradation of NVG performance or could create unnecessary distraction to pilot.</p>	<p>Chart Line:_____</p>

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#	Item	Comment/Remark
4.	<p>NVIS Instrument lights – ON (including filtered instruments)</p> <p>NVIS flood lights – OFF</p> <p>NVIS Filtered Equipment (i.e., radio stacks, GPS, clocks, etc) – ON</p> <p>Illumination level – SET TO NVG OPERATIONAL LEVEL</p> <p>a. View target through aircraft windscreen. Record chart line visibility</p> <p>Acceptable degradation = 12% (one resolution element larger from <u>original</u> resolution)</p> <p>b. Scan the instrument panel and consoles and record any light leaks, “hot spots”, or glare in NVG and its effect on NVG performance.</p> <p>c. Record position, type, and effect of any instrument/equipment light reflections in windscreen/windows seen through the NVG and effect on NVG performance/outside visibility.</p>	<p>Chart Line:_____</p>

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#	Item	Comment/Remark
5.	<p>NVIS Instrument lights – ON (including filtered instruments)</p> <p>NVIS flood lights – ON</p> <p>NVIS Filtered Equipment (i.e., radio stacks, GPS, clocks, etc) - ON</p> <p>Illumination level – SET TO NVG OPERATIONAL LEVEL</p> <p>a. View target through aircraft windscreen. Record chart line visibility</p> <p>Acceptable degradation = 12% (one resolution element from <u>original</u> resolution)</p> <p>b. Scan the instrument panel and consoles and record any light leaks, “hot spots”, or glare in NVG and its effect on NVG performance.</p> <p>c. Record position, type, and effect of any instrument light reflections in windscreen/windows seen through the NVG and effect on NVG performance/outside visibility.</p>	<p>Chart Line:_____</p>

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#	Item	Comment/Remark
6.	<p>NVIS Instrument lights – ON (including filtered instruments)</p> <p>NVIS flood lights – ON</p> <p>NVIS Filtered Equipment (i.e., radio stacks, GPS, clocks, etc) – ON</p> <p>Aft compartment lights (if NVIS compatible) – ON</p> <p>Illumination level – SET TO NVG OPERATIONAL LEVEL</p> <p>a. View target through aircraft windscreen. Record chart line visibility</p> <p>Acceptable degradation = 12% (one resolution element from <u>original</u> resolution)</p> <p>b. Scan the instrument panel and consoles and record any light leaks, “hot spots”, or glare in NVG and its effect on NVG performance.</p> <p>c. Record position, type, and effect of any instrument light reflections in windscreen/windows seen through the NVG and effect on NVG performance/outside visibility.</p> <p>d. Record any glare, reflections from aft compartment lights and effect on NVG performance</p>	<p>Chart Line:_____</p>

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#	Item	Comment/Remark
7.	<p>Master Caution/Warning Lights – ON All other cockpit lights – OPERATIONAL SETTING</p> <p>View target through aircraft windscreen. Record chart line visibility</p> <p>Acceptable degradation = 12% (one resolution element from <u>original</u> resolution)</p> <p>Note: Some Glare/blooming/degradation in NVG performance may be acceptable since Master caution/warning master lights are designed to attract pilot attention. Acceptability dependent on aircraft system, when the lights programmed to illuminate, and position within pilot's NVG FOV. Evaluator Pilot judgment.</p>	Chart Line:_____
8.	<p>Caution Advisory Warning Panel lights – ON All other cockpit lights – OPERATIONAL SETTING</p> <p>View target through aircraft windscreen. Record chart line visibility</p> <p>Acceptable degradation = 12% (one resolution element from <u>original</u> resolution).</p> <p>Note: Some Glare/blooming/degradation in NVG performance may be acceptable since the caution/warning panel lights should attract pilot attention. Dependent on aircraft system, when the lights programmed to illuminate, and position within pilot's NVG FOV. Evaluator Pilot judgment. However, any blooming, glare, degradation of NVG performance beyond 12%, or pilot distraction while using NVGs due to CAWs panel <u>Advisory</u> light illumination is unacceptable.</p>	Chart Line:_____

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#	Item	Comment/Remark
9.	<p>Check pilot's/observer's ability to move in cockpit, view and operate switches/controls with NVG's in viewing and stowed position.</p> <p>Use representative pilot samples (height: 5'2" to 6'0")</p> <p>a. Record Pilot/Observer ability to see/access overhead panel switches/controls.</p> <p>b. Record Pilot/Observer ability to see/access side/center panel switches/controls.</p> <p>c. Record any interference with aircraft ceiling, structures, controls</p>	